The effect of shocks in household debt on health

Master Thesis

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Abstract

The association between shocks in mortgage debt and health is analyzed by using data from the DNB Household survey from 2003 to 2014. Two measures for individual indebtedness are applied: mortgage debt and the Loan-to-Value ratio. Results show that mortgage debt does not have a direct effect on health, but an indirect effect on health through the Loan-to-Value ratio. Problems of reverse causality are reduced by the Dutch medical insurance system and by using a subsample of constantly employed individuals. Fixed effects and instrumental variables are used to reduce the omitted variable bias and to create a case for causality.

Keywords: mortgage debt, loan-to-value, fixed-effects, instrumental variables, health

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1. Introduction

During the last two decades house prices fluctuated largely in the Netherlands: from 2000 till 2008 the Netherlands experienced a house price boom (CBS, 2016) and a so called 'bubble' was created. Households increased their spending because the sky was the limit and household debt increased sharply during this period (Mian and Sufi, 2009). The house price bubble grew bigger every year and busted in 2008, followed by constantly decreasing house prices until 2014 (CBS, 2016). For some households the decline in house prices put their houses 'under water', meaning that the mortgage debt is higher than the value of the corresponding house, resulting in a remaining debt position after selling the house. The European economies are slowly recovering from the crisis and this is partly due to households paying off their mortgage debt because of the decreased house prices (Mian and Sufi, 2011). The fact that a household's home is 'under water' brings along financial stress, and this financial stress from mortgage debt can have an adverse effect on health.

Research has been done on the effect of debt on health in a range of different kinds of debt. Indebted homeowners commit themselves to a timely payment of principal and interest for up to thirty years regardless of any economic conditions. As a result, indebted homeowners are more likely to experience financial stress. Stress can lead to unhealthy behaviours such as smoking, drinking, or substance abuse, or may cause eating disorders and sleep problems (Schneiderman and Ironson, 2008). Nettleton and Burrows (1998) find that mortgage indebtedness is socially patterned, with the groups who are already socio-economically disadvantaged being at most risk of problematic home ownership. They also found that mortgage indebtedness is associated with higher scores on the GHQ12 - a tool designed to measure mental health status, a higher score means a worse mental health. Theoretically, the link between debt and health can be direct, through financial stress, or indirect, through the derived demand for medical care. Mortgage indebtedness is associated with negative health outcomes (Lau and Leung, 2011). Keese and Schmitz (2014) used longitudinal data from Germany and found that individuals with debt are more likely to visit a doctor. Also, Currie and Tekin (2011) used foreclosure data of four states in the USA and found that greater foreclosures is associated with more hospital visits and less preventive medical visits. Nettleton and Burrows (1998) found that mortgage indebted men are associated with increased rate of consultation with general practitioners.

Policies that promote homeownership through financing, such as the Dutch tax deductibility of interest payment on mortgages (in Dutch 'hypotheekrenteaftrek'), may have unintended consequences of impairing health given the negative relationship between debt and health. This is especially the case during economic downturns, as experienced in the Netherlands from 2008 onwards. Prior studies considered the effect of debt on health and only few have looked into the effect of mortgage debt on

health. The collapse of the Dutch housing market during the financial crisis of 2008 and onwards has caused many households houses to be "under water". Has this event created health problems among the highly indebted group of households? The research question therefore is: *What are the effects of shocks in household debt on health?* This paper uses longitudinal data from the DNB Household Survey and a quantitative analysis will be used to determine the effects of shocks in household debt on health.

Lau and Leung (2011) used the household mortgage loan to value and debt-service-to-income ratios (knows as the DTI ratio) to measure the effect of the intensity of mortgage indebtedness on mental and physical health among a nationally representative sample of adults over the age of 50 in the USA. They show that higher mortgage indebtedness is associated with depression, obesity, high blood pressure, diabetes, decline in health, and poor health. Lau and Leung (2011) admit that a limitation of their research is that it is conducted on people over fifty years of age. Since Currie and Tekin (2011) found the most pronounced effects in foreclosure data on those between 20 and 49 years of age, their results might be understated. For further research they suggest to use a dataset which contains younger homeowners. This paper will answer this call by focusing on a representative household data set of the Netherlands which covers the ages of 18 till 65.

Insights from this paper can be used by the Dutch government to transform the Dutch tax deductibility of mortgage payments to a more sustainable solution and to strife for stable house prices, as well as to govern the maximum amount of money one can get a mortgage for, relative to the corresponding house price. The Dutch government can use the results of this paper by adapting their policy on mortgage lending to reduce the adverse effects of debt on health.

This paper shows that a higher loan-to-value ratio (LTV) is associated with a poorer health. Mortgage debt itself does not have a direct effect on health but has an indirect effect on health through the LTV. Reverse causality is countered by the Dutch medical insurance system and a by using a subsample of constantly employed individuals. Fixed effects and house price as an instrument, are used to reduce the omitted variable bias and to create a case for causality.

In the next section, the current literature on the effects of debt on health and especially mortgage debt on health, is reviewed. Subsequently, the methodological framework will be presented where is explained which analysis and variables will be taken into account. After that, the results will be discussed and finally a conclusion and discussion of the research is presented.

2. Literature Review

A few studies have established a link between debt and health and specifically between foreclosure and worsening health. Pollack and Lynch (2009) investigated the health of participants undergoing foreclosure of their homes. The foreclosed were significantly more likely to have hypertension and heart diseases, and to have a clinically diagnosed psychiatric condition than the control group, with 36.7 percent meeting the criteria for a major depression. The foreclosed reported more smoking and more drinking the past month. Cost related medical nonadherence was quite high and more than half the sample reported skipping or delaying a meal because of cost. Given the cross-sectional nature of the study a causal relation was not established. Currie and Tekin (2011) showed an association between foreclosures and hospital visits in four states by zip codes, with the highest impact for those aged 20 to 49. This study is also cross sectional.

Nettleton and Burrows (1998) used the Survey of English Housing and examined two periods, 1991 to 1992 and 1994 to 1995, which was a deep housing depression. GHQ12 scores, ranging from zero for excellent to 35 for very poor, were used to measure mental wellbeing. For men, mortgage problems led to a 1.64 increase in GHQ12 scores; for women it led to a 2.51 increase. Also, indebted men are associated with an increased rate of consultation with general practitioners. Taylor et al. (2006) used data from the British Household Panel Survey from 1991 to 2003 and found psychological effects of being past due on housing debt for men, after controlling for financial conditions and other personal traits. The psychological impact increases with the probability of losing one's home.

These studies investigated individuals in or near foreclosure opposed to all mortgagors. On the other side, several researchers have studied a more general question: the effect of financial distress in general on health. Individuals experiencing financial difficulties were found to be more likely to exhibit a depression (Skapinakis et al. (2006). Skapinakis et al. (2006) used longitudinal data from two periods and thereby establishing a case for causality. Lyons and Yilmazer (2005) and O'Neill et al. (2005) both found a positive correlation between self-reported financial stress and worse sell-reported health. Financial stress, or stress, could stem from a multiple of sources. In contrary, mortgage debt, is an identifiable condition controllable by individuals, lending institutions and government (Lau and Leung, 2011). Kahn and Pearlin (2006) found that long-term financial hardship leads to more (financial) stress and is reflected in a range of poorer health outcomes.

Studies on personal debt found a link between credit card debt to income ratios and physical impairment (Drentea and Lavraskas, 2000). Drentea (2000) used a multivariate analysis to show that a higher credit card debt to income ratio increase anxiety. Browen et al. (2005) find that higher unsecured household debt reduces the probability of scoring the maximum on a test that measure mental health.

Though, they do not get a statically significant result for the effect of mortgage debt, they do find that in general higher credit lines negatively affect mental health.

Keese and Schmitz (2014) measure the effects of consumer debt to income, housing debt to income and over-indebtedness on health satisfaction, mental health and the probability of being obese. The results showed a clear link between more debt and worse mental health and higher incidences of obesity. They also find an effect of mortgage debt affecting mental health, yet in their period there was no housing market downturn such as in the Netherlands. Lau and Leung (2011) found an effect of mortgage debt on health. More specifically, they found a highly significant correlation between loan-to-value and six health outcomes: poor health, negative change in health, obesity, high blood pressure, diabetes and depressive symptoms. Their research period included a housing market downturn in the United States but their data was a representative sample of the United States with the age of 50 or higher and therefore excluding young buyers. Cuesta and Budria (2015) used longitudinal data from the Spanish Survey of Household Finances to investigate the relation between household debt and health and found that hard-up people struggling to pay their debts are more likely to report health problems. They distinguished between mortgage and non-mortgage debts and found that the latter exert the most dramatic impact on the individual's health.

The literature has in general found negative correlations between indebtedness and health. However, this negative correlation could arise from multiple channels. First, there could be an effect from indebtedness causing bad health, i.e. the effect of interest in this paper. Second, the correlation may stem from bad health causing higher indebtedness (i.e. reverse causality). Third, other factors, such as unemployment, can lead to both bad health due to financial distress and high indebtedness due to financial constraints in repaying back the loan.

To identify the effect of interest, Lau and Leung (2011) exploit the house price shock in the United States following the financial crisis starting in 2007, to identify the effect of indebtedness (measured by the loan-to-value ratio) on health. This paper uses a similar identification strategy as Lau and Leung (2011), by exploiting regional variation in house prices following the financial crisis. The key idea is that aggregate house price changes are exogenous to the homeowner, giving variation in indebtedness, and study the health outcomes of households differentially exposed to the shocks.

This paper researches the effect of shocks in mortgage debt on health using the following hypothesises:

H1: Change in loan-to-value negatively affects health

H2: Change in loan-to-value has a negatively causal effect on health

It is expected that H1 will give a significant effect based on literature mentioned above. This paper hopes to find a significant causal effect with H2 and thereby contributing to the existing literature.

3. Methodology

This paper uses longitudinal data from the DNB Household Survey for the years 2003 to 2014[1]. This dataset started in 1993 and surveyed about 2000 households each year on a wide range of topics including work, pensions, living, mortgages, income, personal assets, loans, health, economical- and physiological concepts, and personal characteristics. The questionnaire surveys both the individual and the household level and the analysis of the effect of mortgage debt on health is done on an individual level.

The analysis is based on adult individuals below the age of 65 since the elderly usually do not take out loans in the same magnitude as do working-age individuals (Keese & Schmitz, 2014). At the same time, they naturally face more health problems. It is important to include adults from age 18 till 50 since Lau & Leung (2011) only used a population of over age 50 in their research. Therefore, our analysis focuses on the active Dutch population, from the age of 18 till 65.

The chosen period of 2003 to 2014 consists of two smaller periods, namely 2003 till 2008 and 2009 till 2014. In the first period, the Dutch house market experienced an average increase of more than 21.6% (CBS, 2016). Then the global financial crisis took off and house prices started to decline in the second period by 18.7% (CBS, 2016). Combining both periods results in a swing in house prices of 40.3%. This paper aims find a causal relationship between mortgage debt and health by using OLS estimations, fixed effect, random effects and 2SLS.

A potential problem for the causal relationship is reverse causality. In the Netherlands, you are legally obliged to take out a standard health insurance (Rijksoverheid, 2016) so the health insurance system covers basically all medical expenses. Therefore a direct effect of health on debt due to high medical bills can be excluded. However, individuals may become unemployed or be forced to leave the labour market because of an adverse health shock and, consequently, get into trouble repaying their debt. This paper deals with this indirect effect of health on debt problem with a robustness check by using a subsample of constantly employed individuals, thus excluding individuals that might have stopped working due to bad health (Keese & Schmitz, 2014), and also excluding non-working individuals (e.g. students, housewives). There are also other events which may result in changes in the household composition such as divorce, separation, or death of the partner. These events might have their own effects on health and the financial situation and are therefore controlled for.

The data is selected on age, 18 till 65, and on people who are owners of a house. We exclude farm or gardener's house, dwelling with shop or workshop, other dwelling on business premises, rent a room,

[1] The data is provided by CentERdata, which executes the DNB Household Survey commissioned by the Dutch Central Bank. The data is extracted in Stata files.

and other sort of accommodation. We control for age, sex, marital status, location, highest completed education, (log) income, children, different kinds of mortgages, occupation (job or no job) and chronical diseases. Education is an important variable in the production of health (Grossman, 1972) and therefore we control for education.

3.1. Variable definitions

Two variables are used to measure mortgage debt: The loan-to-value ratio (LTV) and log mortgage debt. The survey provides data on the current mortgage debt left. The LTV is used to approximate the burden of mortgage indebtedness and is calculated as the ratio of the amount of mortgage debt outstanding to the current house price. The Dutch Valuation of Real Estate (WOZ-value) is used for the current house price. When house prices decline, homeowners with high LTVs cannot reduce housing consumption accordingly and if they sell the house, they are more likely to incur a financial loss due to lower prices and transaction fees. For homeowners without mortgage debt, the mortgage debt outstanding was set to a tenth of a cent so that the natural log of the mortgage debt can be calculated for the values.

Health is measured as a categorical variable where 1 indicates excellent health, 2 indicates good health, 3 indicates fair health, 4 indicates not so good health, and 5 indicates poor health. So a higher score indicates a poorer health.

The methodology of the DNB Household survey is followed for identifying the observations: A unique ID number for each individual consisting out of 'Household number' * 100 + 'Personal number of the household' is used, combined with the 'year' variable to order the data.

3.2. Summary statistics

After selecting the data and dropping all missing's and outliers, 3.347 observations remain for the period 2003 till 2014. The important independent and dependent variables are summarized in Table 1 in order to see the trends in the data. All variables are summarized in Table 2, see appendix.

Table 1: Summary statistics of main variables (averages 2003 – 2014) Mortgage debt and House prices x€1000

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Mortgage debt	91,06	93,45	98,09	108,96	120,31	125,56	129,95	135,92	138,86	147,08	151,50	154,77
House Price	159,03	153,72	200,43	209,55	223,06	241,63	250,37	246,40	252,00	267,54	252,12	238,72
Loan to Value	57%	61%	49%	52%	54%	52%	52%	55%	55%	55%	60%	65%
Health	2,13	2,00	1,90	1,99	1,98	2,01	2,01	1,99	2,08	1,96	1,99	1,98

The health variable ranges from 1 to 5 and a higher score means worse health. The mortgage debt and house prices are in 1000's of Euro's. The averages show that mortgage debt is ever increasing from 2003 till 2014. House prices took a little plunge in 2004 and then continued to increase till 2012 and from there on started to decrease. There is little variation in the Loan to Value ratio from 2006 till 2012 and afterwards starts to increase sharply. The house prices numbers used by the Dutch Central Bureau for Statistics (CBS) differ from the dataset due to the numbers of CBS are based on houses sold and the dataset is based on the Dutch Valuation of Real Estate (also called WOZ value) which is annually set by the local municipality.

3.3. Estimation strategy

Four estimates are used to research the effect of mortgage debt on health: Pooled OLS, fixed effects, random effects and instrumental variable. The regression functions are given below.

The reduced form model for health as a function of the Loan to Value ratio (LTV) and socioeconomic factors is given by:

$$H_{it} = \beta_0 + \beta_1 LTV_{it} + X_{it}\theta + \varepsilon_{it} \quad (1)$$

Where H is the health variable, LTV_{it} is the ratio of the mortgage debt divided by the corresponding house price, X_{it} is a vector of socioeconomic variables for individual i in year t, θ is a vector of parameters for the effects of the socioeconomic factors, and ε_{it} is the error term. Mortgage debt varies across individuals and over time due to the option of refinancing, repaying or the amortization structure of mortgage loans. The house prices vary over time due to the market price mechanism.

In addition to the standard OLS, we control for unobserved heterogeneity by using the fixed-effects estimation method. The effect of time-invariant characteristics are removed so the net effect of the predictors on the dependent variable can be assessed. It is assumed that the unobserved individual traits, such as risk aversion or time preference, are constant over time (or at least in the twelve year period of this study, which is a less restrictive assumption). With this assumption the fixed-effect model controls for the omitted variable bias and is formulated in the following estimating equation:

$$H_{it} = \beta_0 + \beta_1 LTV_{it} + X_{it}\theta + \alpha_i + \varepsilon_{it} \quad (2)$$

Where *H* is the health variable, LTV_{it} is the ratio of the mortgage debt divided by the corresponding house price, X_{it} is a vector of socioeconomic variables for individual *i* in year *t*, θ is a vector of parameters for the effects of the socioeconomic factors, α_i is the unobserved time-invariant individual effect, and ε_{it} is the error term.

A Random effects model is executed as well and a Hausman test and Mundlak's approach will determine if the Fixed effects or Random effects outcome is leading for this study. Random effects assumes that the unobserved individual effect embodies elements that are random and uncorrelated with the predictors in the model (Greene, 2008) by using the following estimation:

$$H_{it} = \beta_0 + \beta_1 X_{it} + \alpha + u_{it} + \varepsilon_{it} \tag{3}$$

Where *H* is the health variable, X_{it} is a vector of socioeconomic variables for individual *i* in year *t*, α is the unobserved time-invariant individual effect, u_{it} is the between-entity error, and ε_{it} is the within-entity error term.

An unobserved negative health shock could lead to both a higher LTV and poor health (Lau & Leung, 2011). In order to address the endogeneity between LTV and the error term, the instrument house prices is used. The exogenous variation in house prices can be used to instrument for housing leverage (LTV). Our period covers a boom and bust in house prices and makes it a relevant and exogenous instrument for this study. Assuming that house prices affect health only through its effect on LTV, a causal effect of LTV on health can be identified. 2SLS is used with the WOZ values of the corresponding house as the instrument in the following equation:

First stage: $$LTV_{it} = \beta_0 + \delta\, X_{it} + \gamma\, Z_{it} + \varepsilon 1_{it} \tag{4}$$

Second stage: $$H_{it} = \beta_0 + \beta_1 Fitted\_LTV_{it} + X_{it}\theta + \varepsilon 2_{it} \tag{5}$$

For the first stage: LTV_{it} is the ratio of the mortgage debt divided by the corresponding house price, X_{it} is the vector of socioeconomic variables for individual *i* in year *t*, Z_{it} is the instrumental variable house price, and $\varepsilon 1_{it}$ is the standard error of the first stage. For the second stage: *H* is the health variable, $Fitted\_LTV_{it}$ is the LTV with the instrument in it, X_{it} is a vector of socioeconomic variables for individual *i* in year *t*, θ is a vector of parameters for the effects of the socioeconomic factors, and $\varepsilon 2_{it}$ is the error term of the second stage. Self-reported house values are in general overestimated in the

range of 10% (Engelhardt, 2003). The DHS Household Survey asks the individuals to fill in the Dutch Valuation for Real Estate value (WOZ-Value) which is determined by their local municipality and therefore the overestimation effect is expected to be minimal.

4. Results

An overview of the results of all tests can be found in Table 3 for a quick interpretation of the results. The specified outcomes of all tests are put into their corresponding table.

4.1. Pooled OLS

Table 4 reports the OLS results of the Loan to Value ratio (LTV) on health for the home owning population of the DNB Household survey. The main independent variable of interest is LTV: Does a higher LTV lead to a poorer health? We control for income, age, age squared, gender, employment, marital status, education, location, chronic diseases, and different mortgages. Based on the collinearity test of predictors, the following variables were excluded from the OLS: age squared, interest only mortgage, and married with community of property. The OLS estimation shows a positive relationship between LTV and health. A higher LTV leads to a higher score on health, which means a worse health outcome and is significant (5%). The coefficient of LTV on health is 0.0979 with a robust standard error (clustered on ID) of 0.0426. Stated otherwise, on average if LTV increases by 1 then health increases by 0.0979 (where a higher score means poorer health). Lau & Leung (2010) found a coefficient of LTV on health of 0.0239 with a standard error of 0.00435 and 1% significance (also clustered on ID). This shows that the effect in our study is greater in terms of coefficients but also carries a higher standard error relative to the coefficient than Lau & Leung (2010).

A robustness check is applied in order to test how solid this effect of LTV on health is. Another OLS with log mortgage debt was carried out in order to see if mortgage debt on itself would have an effect on health, see Table 5. We control for the same variables as in the standard OLS and added the variable log house price as well. We find a positive significant effect (10%) of mortgage debt on health (where a higher score means poorer health). The minimum threshold is 5% so the direct effect of mortgage debt on health is not recognized but we acknowledge that there is a weak effect.

A second robustness check is an OLS on a subsample with people who were constantly employed during the period in order to rule out the effect of reverse causality, see Table 6. Individuals may become unemployed or be forced to leave the labour market because of an adverse health shock and, consequently, get into trouble repaying their debt. The OLS estimation shows that, with a subsample of constantly employed individuals, the positive effect of LTV on health (where a higher number means worse health) still holds (significant on 5%).

4.2. Fixed effects and Random effects

In this section we employ the Fixed effects model to control for endogeneity between the error terms and the predictors due to unobserved characteristics of the individuals, see Table 7. With Fixed effects, the size of the coefficient of LTV decreases, as expected, and is not significant anymore ($p = 0.100$), which is not expected. Apparently, unobservable factors that influence both health and mortgage debt play an important role in explaining the correlation between mortgage debt and health.

A Random effects test is executed and is highly significant (1%), see Table 8. Yet the Hausman Test and Mundlak's approach (see Table 9) tells us to use Fixed effects and no significant results are found. This suggests that not enough covariates are included in the Fixed effects model to control for unobserved characteristics of individuals. The Fixed effects standard error of the variable LTV (0.0494) is relatively high compared to the coefficient (0.0813) which suggest that there is little variability in the variables over time. Another factor is that the unobserved effects like risk aversion may have changed during the boom and bust period.

4.3. Instrumental Variable

Table 10 show the results of the 2SLS estimation. We use house prices (WOZ values) as an instrument in the endogenous variable Loan to Value ratio (LTV) and find a significant positive effect at the 5% level on the health variable (where a higher number means worse health). Table 11 shows the endogenous check and the relevance of the instrument. The null hypothesis of 'all variables are exogenous' is rejected on a 5% level and we should treat LTV as an endogenous variable. The F-statistic of 52.855 is higher than the critical values of the lower table, thus we reject the null hypothesis that our instrument is weak. Worth noting is the low partial R-squared correlation of 0.0453 which means that the instrument barely correlates with the endogenous variable, LTV. Yet, the instrument house price is still significant and the coefficient of 0.560 is very high, and even higher than the coefficient of the standard OLS, which is 0.0979.

5. Conclusion

The relationship of mortgage debt and health is analysed using a large and representative panel dataset, the DNB Household survey, for the years 2003-2014. The findings show that a higher Loan to Value ratio (LTV) is positively related to self-reported health (where a higher number means worse health), which is in accordance with the existing literature. This effect is significant over a period that includes a boom and bust in housing prices. Mortgage debt itself does not have a (strong) direct effect on health but a significant indirect positive effect through the LTV ratio. Reverse causality was ruled out by the Dutch medical insurance system and a significant effect of LTV on health with an always employed subsample. By employing the fixed effects model we did not find a significant effect of LTV on health, which was not expected. Random effects did find a significant effect of LTV on health, however the Hausman test and Mundlak's test pointed towards the non-significant Fixed effects direction. The house prices (WOZ values) were used as an instrument for the LTV ratio and we found a significant positive effect on health (where a higher number means worse health), creating a case for causality. The practical insights of these findings is that mortgage indebtedness on itself is not causing health problems, but the mortgage debt relative to the house value. This paper adds to the literature by affirming that a higher LTV leads to poorer health on a population of age 18 till 65, in addition to Lau & Leung (2011). The Dutch government should enforce lower LTV ceilings for civilians when they take out mortgage debt as well as trying to keep the housing market as stable as possible.

A limitation of this paper is that the Fixed effects model did not show a significant effect of LTV on health. The explanation is twofold: the variation in health over time for an individual was small and we did not include enough variables to control for unobserved heterogeneity. An endogeneity problem might arise from omitted time-varying variables that can be correlated with the health status and the mortgage debt situation, and we could not solve this econometrically. Another limitation is that the survey uses self-reported health on only a five point scale. Self-reported health is prone to subjectivity and a further recommendation for research is to measure health in more dimensions, such as body mass index and mental health.

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7. Appendix

7.1. Table 1: Summary of main variables

Table 1: Summary statistics of main variables (averages 2003 – 2014) Mortgage debt and House prices are x€1000

	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Mortgage debt	91,06	93,45	98,09	108,96	120,31	125,56	129,95	135,92	138,86	147,08	151,50	154,77
House Price	159,03	153,72	200,43	209,55	223,06	241,63	250,37	246,40	252,00	267,54	252,12	238,72
Loan to Value	57%	61%	49%	52%	54%	52%	52%	55%	55%	55%	60%	65%
Health	2,13	2,00	1,90	1,99	1,98	2,01	2,01	1,99	2,08	1,96	1,99	1,98

7.2. Table 2: Summary statistics of all variables

Variable	Obs	Mean	Std. Dev.	Min	Max
health	3,346	2.004782	.6107956	1	5
mortgage	3,346	120.6706	89.62556	.001	650
wozvalue	3,346	221.1844	105.5692	.001	968
ltv	3,336	.5926629	.3928903	.0040486	2.4
income	3,346	42530.28	27345.29	.001	600000
log_income	3,346	10.40192	1.436754	-6.907755	13.30468
age	3,346	47.20502	9.99386	24	65
age2	3,346	2328.161	929.2429	576	4225
male	3,346	.7603108	.4269576	0	1
marriedcp	3,346	.6043036	.4890728	0	1
marriedms	3,346	.0860729	.2805136	0	1
divorced	3,346	.0585774	.2348672	0	1
livingtoge~r	3,346	.1066946	.3087707	0	1
widowed	3,346	.0056784	.0751523	0	1
never_marr~d	3,346	.138673	.3456567	0	1
children	3,346	.4892409	.4999589	0	1
low_edu	3,346	.275254	.446709	0	1
mid_edu	3,346	.5379558	.4986318	0	1
high_edu	3,346	.1867902	.3898013	0	1
p_groningen	3,346	.041841	.2002556	0	1
p_friesland	3,346	.0487149	.2153035	0	1
p_drenthe	3,346	.0295876	.1694719	0	1
p_overijssel	3,346	.0687388	.2530472	0	1
p_flevoland	3,346	.0257023	.1582694	0	1
p_gelderland	3,346	.1207412	.325875	0	1
p_utrecht	3,346	.0606695	.2387587	0	1
p_noordhol~d	3,346	.1488344	.3559784	0	1
p_zuidholl~d	3,346	.1957561	.3968409	0	1
p_zeeland	3,346	.024208	.1537174	0	1
p_noordbra~t	3,346	.1449492	.3521022	0	1
p_limburg	3,346	.090257	.2865925	0	1
chronic	3,346	.1745368	.3796271	0	1
d_mort1	3,346	.0821877	.2746915	0	1
d_mort2	3,346	.0759115	.2648961	0	1
d_mort3	3,346	.2904961	.4540592	0	1
d_mort4	3,346	.011058	.1045895	0	1
d_mort5	3,346	.0032875	.057251	0	1
d_mort6	3,346	.123431	.3289804	0	1
d_mort7	3,346	.350269	.4771254	0	1
d_mort8	3,346	.0104603	.1017543	0	1
d_mort9	3,346	.0116557	.1073466	0	1
d_mort10	3,346	.011058	.1045895	0	1
d_mort11	3,346	.0301853	.1711225	0	1
employed	3,346	.9130305	.2818325	0	1

7.3. Table 3: Overview of all tests

Table 3: Overview of all tests for 2003-2014. See corresponding appendices for all the output.

	(1) OLS	(2) FE	(3) RE	(4) IV	(5) OLS Constantly Employed	(6) Log Mortgage Debt
	health	health	health	health	health	health
ltv	0.0979**	0.0813	0.0860***	0.560**	0.106**	
	(0.0426)	(0.0494)	(0.0330)	(0.247)	(0.0432)	
log_mortgage						0.0276*
						(0.0143)
log_income	-0.00606	-0.00749	-0.00659	-0.00928	0.000989	0.00803
	(0.0110)	(0.00910)	(0.00770)	(0.0122)	(0.0115)	(0.0111)
age	0.00349	0.0425	0.00534***	0.0111**	0.00405*	0.00243
	(0.00234)	(0.0413)	(0.00161)	(0.00472)	(0.00231)	(0.00224)
employed	-0.137**	0.0173	-0.0430	-0.130**		-0.149***
	(0.0551)	(0.0398)	(0.0333)	(0.0560)		(0.0549)
marriedms	-0.149**	0.0199	-0.0696	-0.155**	-0.152**	-0.150**
	(0.0654)	(0.0694)	(0.0429)	(0.0668)	(0.0691)	(0.0656)
divorced	-0.179**	-0.107	-0.124**	-0.196***	-0.212***	-0.180**
	(0.0715)	(0.0831)	(0.0558)	(0.0743)	(0.0690)	(0.0719)
livingtogether	-0.0143	0.280***	0.0836**	-0.0617	-0.00646	-0.0105
	(0.0526)	(0.0711)	(0.0419)	(0.0630)	(0.0524)	(0.0524)
never_married	0.0834	0.274***	0.133***	0.0811	0.0470	0.0832
	(0.0609)	(0.0842)	(0.0447)	(0.0628)	(0.0604)	(0.0612)
children	0.0356	0.00735	0.0484*	0.0553	0.0244	0.0308
	(0.0385)	(0.0427)	(0.0276)	(0.0397)	(0.0376)	(0.0383)
chronic	0.588***	0.239***	0.403***	0.576***	0.567***	0.593***
	(0.0535)	(0.0345)	(0.0275)	(0.0552)	(0.0545)	(0.0534)
high_edu	-0.151***		-0.170***	-0.178***	-0.182***	-0.155***
	(0.0548)		(0.0439)	(0.0598)	(0.0560)	(0.0550)
p_gelderland	-0.0427	0.606*	0.115	-0.0378	-0.127	-0.0478
	(0.130)	(0.312)	(0.0990)	(0.122)	(0.130)	(0.130)
d_mort2	0.0423	0.126*	0.0607	0.0760	0.0453	0.0379
	(0.0722)	(0.0699)	(0.0473)	(0.0764)	(0.0731)	(0.0720)
d_mort6	-0.0931*	0.00569	-0.0271	-0.153**	-0.0857	-0.0881*
	(0.0514)	(0.0497)	(0.0375)	(0.0645)	(0.0527)	(0.0515)
d_mort10	-0.0846	-0.261*	-0.161*	-0.109	-0.0481	-0.0896
	(0.0919)	(0.144)	(0.0945)	(0.103)	(0.0941)	(0.0912)
Observations	3,336	3,336	3,336	3,336	3,046	3,346
R-squared	0.186	0.045		0.128	0.175	0.185
Number of id		1,054	1,054			

*** p<0.01, ** p<0.05, * p<0.1

Robust standard errors clusteren by ID in parentheses, except for FE and RE.

All non-significant variables have been left out for the sake for brevity, except for log_income

7.4. Table 4: Standard OLS

	(1) OLS health
ltv	0.0979**
	(0.0426)
log_income	-0.00606
	(0.0110)
age	0.00349
	(0.00234)
male	-0.00867
	(0.0434)
employed	-0.137**
	(0.0551)
marriedms	-0.149**
	(0.0654)
divorced	-0.179**
	(0.0715)
livingtogether	-0.0143
	(0.0526)
never_married	0.0834
	(0.0609)
children	0.0356
	(0.0385)
mid_edu	0.0161
	(0.0403)
high_edu	-0.151***
	(0.0548)
chronic	0.588***
	(0.0535)
p_groningen	-0.0467
	(0.153)
p_friesland	-0.0588
	(0.129)
p_drenthe	-0.0482
	(0.132)
p_overijssel	-0.0347
	(0.124)
p_flevoland	0.0799
	(0.155)
p_gelderland	-0.0427
	(0.130)
p_utrecht	-0.0561
	(0.123)
p_noordholland	-0.0381
	(0.123)
p_zuidholland	0.0337
	(0.123)
p_noordbrabant	-0.128
	(0.126)

Table 5: Log mortgage debt OLS

	(1) Log Mortgage Debt health
log_mortgage	0.0276*
	(0.0143)
log_wozvalue	-0.0195
	(0.0259)
log_income	0.00803
	(0.0111)
age	0.00243
	(0.00224)
male	-0.0150
	(0.0434)
employed	-0.149***
	(0.0549)
marriedms	-0.150**
	(0.0656)
divorced	-0.180**
	(0.0719)
livingtogether	-0.0105
	(0.0524)
never_married	0.0832
	(0.0612)
children	0.0308
	(0.0383)
mid_edu	0.00918
	(0.0404)
high_edu	-0.155***
	(0.0550)
chronic	0.593***
	(0.0534)
p_groningen	-0.0414
	(0.152)
p_friesland	-0.0590
	(0.129)
p_drenthe	-0.0501
	(0.132)
p_overijssel	-0.0376
	(0.124)
p_flevoland	0.0749
	(0.155)
p_gelderland	-0.0478
	(0.130)
p_utrecht	-0.0608
	(0.123)
p_noordholland	-0.0456
	(0.124)
p_zuidholland	0.0257
	(0.123)

p_limburg	-0.0129
	(0.129)
d_mort1	0.0185
	(0.0559)
d_mort2	0.0423
	(0.0722)
d_mort3	-0.0430
	(0.0423)
d_mort4	-0.0811
	(0.178)
d_mort5	0.180
	(0.191)
d_mort6	-0.0931*
	(0.0514)
d_mort9	0.0956
	(0.0880)
d_mort10	-0.0846
	(0.0919)
d_mort11	0.0497
	(0.0959)
Observations	3,336
R-squared	0.186

*** p<0.01, ** p<0.05, * p<0.1
Robust standard errors clustered on ID in parentheses

p_noordbrabant	-0.135
	(0.126)
p_limburg	-0.0155
	(0.129)
d_mort1	0.0144
	(0.0557)
d_mort2	0.0379
	(0.0720)
d_mort3	-0.0434
	(0.0427)
d_mort4	-0.117
	(0.175)
d_mort5	0.193
	(0.201)
d_mort6	-0.0881*
	(0.0515)
d_mort9	0.112
	(0.0895)
d_mort10	-0.0896
	(0.0912)
d_mort11	0.0472
	(0.0947)
Observations	3,346
R-squared	0.185

*** p<0.01, ** p<0.05, * p<0.1
Robust standard errors clustered on ID in parentheses

7.5. Table 6: Always employed OLS

	(1) OLS Constantly Employed health
ltv	0.106**
	(0.0432)
log_income	0.000989
	(0.0115)
age	0.00405*
	(0.00231)
male	6.88e-06
	(0.0435)
marriedms	-0.152**
	(0.0691)
divorced	-0.212***
	(0.0690)
livingtogether	-0.00646
	(0.0524)
never_married	0.0470
	(0.0604)
children	0.0244
	(0.0376)
mid_edu	-0.00944
	(0.0421)
high_edu	-0.182***
	(0.0560)
chronic	0.567***
	(0.0545)
p_groningen	-0.0832
	(0.158)
p_friesland	-0.0847
	(0.131)
p_drenthe	-0.0769
	(0.136)
p_overijssel	-0.0580
	(0.126)
p_flevoland	0.0893
	(0.155)
p_gelderland	-0.127
	(0.130)
p_utrecht	-0.0921
	(0.125)
p_noordholland	-0.0554
	(0.125)
p_zuidholland	0.0237
	(0.124)
p_noordbrabant	-0.171
	(0.128)
p_limburg	-0.0237
	(0.130)
d_mort1	0.0205
	(0.0510)

d_mort2	0.0453
	(0.0731)
d_mort3	-0.0321
	(0.0425)
d_mort4	-0.0219
	(0.206)
d_mort5	0.00951
	(0.130)
d_mort6	-0.0857
	(0.0527)
d_mort9	0.107
	(0.0971)
d_mort10	-0.0481
	(0.0941)
d_mort11	0.0685
	(0.0980)
Observations	3,046
R-squared	0.175

*** p<0.01, ** p<0.05, * p<0.1
Robust standard errors clustered on ID in parentheses

7.6. Table 7: Fixed Effects

	(1) FE health
ltv	0.0813
	(0.0494)
log_income	-0.00749
	(0.00910)
age	0.0425
	(0.0413)
employed	0.0173
	(0.0398)
marriedms	0.0199
	(0.0694)
divorced	-0.107
	(0.0831)
livingtogether	0.280***
	(0.0711)
never_married	0.274***
	(0.0842)
children	0.00735
	(0.0427)
chronic	0.239***
	(0.0345)
p_groningen	0.189
	(0.624)
p_friesland	0.284
	(0.430)
p_drenthe	0.176
	(0.485)
p_overijssel	0.293
	(0.440)
p_gelderland	0.606*
	(0.312)
p_utrecht	0.203
	(0.413)
p_noordholland	0.184
	(0.528)
p_zuidholland	0.124
	(0.394)
p_noordbrabant	0.0679
	(0.206)
d_mort1	-0.0298
	(0.0635)
d_mort2	0.126*
	(0.0699)
d_mort3	-0.00890
	(0.0486)
d_mort4	0.0824

7.7. Table 8: Random Effects

	(1) RE health
ltv	0.0860***
	(0.0330)
log_income	-0.00659
	(0.00770)
age	0.00534***
	(0.00161)
male	-0.0247
	(0.0350)
employed	-0.0430
	(0.0333)
marriedms	-0.0696
	(0.0429)
divorced	-0.124**
	(0.0558)
livingtogether	0.0836**
	(0.0419)
never_married	0.133***
	(0.0447)
children	0.0484*
	(0.0276)
mid_edu	1.00e-05
	(0.0329)
high_edu	-0.170***
	(0.0439)
chronic	0.403***
	(0.0275)
p_groningen	0.176
	(0.117)
p_friesland	0.0100
	(0.113)
p_drenthe	0.0342
	(0.123)
p_overijssel	0.0961
	(0.103)
p_flevoland	0.145
	(0.124)
p_gelderland	0.115
	(0.0990)
p_utrecht	0.103
	(0.106)
p_noordholland	0.0720
	(0.0979)
p_zuidholland	0.114
	(0.0954)
p_noordbrabant	0.0297

	(0.192)
d_mort5	0.196
	(0.200)
d_mort6	0.00569
	(0.0497)
d_mort9	-0.0402
	(0.136)
d_mort10	-0.261*
	(0.144)
d_mort11	-0.0673
	(0.0825)
y2003	0.313
	(0.434)
y2004	0.363
	(0.393)
y2005	0.308
	(0.351)
y2006	0.311
	(0.310)
y2007	0.240
	(0.269)
y2008	0.162
	(0.228)
y2009	0.177
	(0.187)
y2010	0.125
	(0.147)
y2011	0.0757
	(0.107)
y2012	0.0442
	(0.0695)
Observations	3,336
Number of id	1,054
R-squared	0.045

*** p<0.01, ** p<0.05, * p<0.1
Standard errors in parentheses

	(0.0970)
p_limburg	0.104
	(0.104)
d_mort1	-0.00201
	(0.0446)
d_mort2	0.0607
	(0.0473)
d_mort3	-0.0388
	(0.0310)
d_mort4	-0.00831
	(0.117)
d_mort5	0.164
	(0.162)
d_mort6	-0.0271
	(0.0375)
d_mort9	0.0613
	(0.101)
d_mort10	-0.161*
	(0.0945)
d_mort11	-0.00186
	(0.0611)
Observations	3,336
Number of id	1,054

*** p<0.01, ** p<0.05, * p<0.1
Standard errors in parentheses

7.8. Table 9: Hausman and Mundlak's tests

```
    Test:  Ho:  difference in coefficients not systematic

                 chi2(28) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =      103.68
                Prob>chi2 =      0.0000

.   estimates store mundlak


    test m_ltv m_job m_age m_income m_chronic

   ( 1)  m_ltv = 0
   ( 2)  m_job = 0
   ( 3)  m_age = 0
   ( 4)  m_income = 0
   ( 5)  m_chronic = 0

             chi2(  5) =   46.57
           Prob > chi2 =    0.0000
```

Table 10: IV

	(1) IV health
ltv	0.560**
	(0.247)
log_income	-0.00928
	(0.0122)
age	0.0111**
	(0.00472)
male	0.0123
	(0.0451)
employed	-0.130**
	(0.0560)
marriedms	-0.155**
	(0.0668)
divorced	-0.196***
	(0.0743)
livingtogether	-0.0617
	(0.0630)
never_married	0.0811
	(0.0628)
children	0.0553
	(0.0397)
mid_edu	0.0180
	(0.0418)
high_edu	-0.178***
	(0.0598)
chronic	0.576***
	(0.0552)
p_groningen	-0.130
	(0.159)
p_friesland	-0.103
	(0.124)
p_drenthe	-0.0691
	(0.130)
p_overijssel	-0.0334
	(0.115)
p_flevoland	0.0781
	(0.146)
p_gelderland	-0.0378
	(0.122)
p_utrecht	-0.0676
	(0.114)
p_noordholland	-0.0434
	(0.114)
p_zuidholland	0.0334
	(0.113)
p_noordbrabant	-0.112
	(0.119)
p_limburg	-0.00885
	(0.121)

d_mort1	0.133
	(0.0842)
d_mort2	0.0760
	(0.0764)
d_mort3	-0.0156
	(0.0443)
d_mort4	0.0476
	(0.185)
d_mort5	0.246
	(0.223)
d_mort6	-0.153**
	(0.0645)
d_mort9	0.0111
	(0.0990)
d_mort10	-0.109
	(0.103)
d_mort11	-0.0611
	(0.110)
Observations	3,336
R-squared	0.128

*** p<0.01, ** p<0.05, * p<0.1
Robust standard errors clusteren on ID in parentheses

7.9. Table 11: IV tests of endogeneity and weak instruments

Tests of endogeneity
Ho: variables are exogenous

Robust regression F(1,1053) = 4.08068 (p = 0.0436)
(Adjusted for 1054 clusters in id)

First-stage regression summary statistics

Variable	R-sq.	Adjusted R-sq.	Partial R-sq.	Robust F(1,1053)	Prob > F
ltv	0.3714	0.3651	0.0453	52.8554	0.0000

(F statistic adjusted for 1054 clusters in id)

Minimum eigenvalue statistic = 156.701

Critical Values # of endogenous regressors: 1
Ho: Instruments are weak # of excluded instruments: 1

	5%	10%	20%	30%
2SLS relative bias	(not available)			

	10%	15%	20%	25%
2SLS Size of nominal 5% Wald test	16.38	8.96	6.66	5.53
LIML Size of nominal 5% Wald test	16.38	8.96	6.66	5.53